Reasonable Grounds Documentation to conduct an Aquatic Life Use Attainability Analysis for Straight Creek, Lee County, Virginia under VAC 62.1-44.19:7

Submitted To:

Virginia State Water Control Board

Submitted By:

Virginia Coalfields TMDL Group

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1.0 Introduction / Background

1.1 General

In 2006, the Virginia General Assembly amended Va. Code § 62.1-44.19:7 to provide a process for evaluating the attainability of designated uses (Acts of Assembly Chapter 154). The amendment reads as follows:

> *If an aggrieved party presents to the Board reasonable grounds indicating that the attainment of the designated use for a water is not feasible, then the Board, after public notice and at least 30 days provided for public comment, may allow the aggrieved party to conduct a use attainability analysis according to criteria established pursuant to the Clean Water Act and a schedule established by the Board. If applicable, the schedule shall also address whether TMDL development or implementation for the water should be delayed.*

The amendments contemplate that the proponent of a use attainability analysis (UAA) will offer justification to VDEQ, who in turn will provide opportunity for public review and then action by the State Water Control Board. The Board will allow the proponent to conduct a UAA where there are reasonable grounds to indicate that attainment is not feasible. The UAA must comply with relevant regulatory criteria (40 CFR 131.10(g) and 9 VAC 25-260-10 G). The results of the UAA may provide a basis for amending designated uses and/or the criteria assigned to protect those uses (see, for example, the refined uses and criteria for aquatic life in the Chesapeake Bay watershed).

The Virginia Coalfields TMDL Group is interested in conducting a UAA in Straight Creek. This report outlines the various factors that may prevent attainment of the designated aquatic life use in Straight Creek. The Group respectfully submits that these factors meet the "reasonable grounds" standard in Va. Code § 62.1-44.19:7 for the Board to allow a UAA.

1.2 Watershed Background

Straight Creek is located in Lee County, Virginia and is a tributary of the Powell River / Upper Tennessee River system. The headwaters begin near the Kentucky / Virginia border and flow south through the town of St. Charles and connect to the North Fork Powell River near Pennington Gap Virginia. Straight Creek reaches fourth order status after the confluence of Stone Creek near the mouth. The area is located on the Pennington Gap USGS 7.5' quadrangle. Maps of the area are presented as Figures 1 and 2.

Landuses in the watershed include forest, residential and mining. This watershed has a long history (over 100 years) of timber harvesting, mining and residential influences. The narrow valley floor of Straight Creek has received the majority of the persistent human disturbance (Photos 1, 2). The Straight Creek watershed has approximately 1200 buildings, a network of roads, more than 25 bridges, a railroad, and approximately 2210 acres of historical (*i.e.*, Pre Law SMCRA 1978) mining.

1.3 Project Statement

Straight Creek has been identified as attaining neither its designated aquatic life use (benthic impairment), nor its primary contact recreation use (fecal bacteria impairment). Virginia DEQ has studied conditions in the creek and determined that the uses may be restored through implementation of controls on bacteria, Total Dissolved Solids (TDS), and Total Suspended Solids (TSS) sources in the Straight Creek watershed. The UAA proposed herein will address only the aquatic life use impairment.

It should be noted that the benthic impairment is at the lower end of the "Moderately Impaired" range. The Straight Creek TMDL report presents 13 biological samples that were collected in Straight Creek from 1991 through 2004. The impairment rating of those samples is on average only 40% comparable to reference streams using the official VDEQ RBPII method of waterbody assessment. In addition to the RBPII method, the VDEQ-validated draft Virginia Stream Condition Index (VSCI) method, scheduled to be

adopted in 2008, was used to score the stream's biological condition in the Straight Creek TMDL report. The VSCI scores averaged 38 out of a possible 100, which is well below the proposed impairment threshold of 60. These data demonstrate that Straight Creek is not simply a few points shy of achieving aquatic life use attainment.

DEQ has not yet had an opportunity to study non-pollutant contributions to impairment or their relative impact on the proposed restoration efforts. While control measures directed at pollutants like bacteria, TDS and TSS may in some cases help to improve biological condition, conventional ecological theory tells us that there are also many non-pollutant factors that influence the aquatic community (USEPA 2005). Straight Creek's non-pollutant factors may hinder restoration, even with pollutant control measures in place. These non-pollutant factors must be addressed if an aquatic life use is to be realistically attainable. Our proposed UAA study will identify and assess pollutant and non-pollutant factors and their possible impacts on use attainment (even with pollutant control measures in place).

A UAA is a structured scientific assessment that examines the factors affecting the attainable use in a body of water. Unlike traditional water quality management (which focuses on pollutants), the UAA process considers <u>all</u> factors affecting the stream, both pollutant and non-pollutant. The UAA also takes into account the social and economic ramifications of conceivable restoration efforts in the watershed. UAAs are especially valuable in watersheds where the stream cannot meet its designated use due to factors outlined in 40 CFR 131.10(g). UAAs help to validate the existing designated uses or highlight changes that may be necessary (either to those uses or the criteria assigned to protect them). The UAA for the Chesapeake Bay is a leading example (albeit on a much larger scale) of a successful study that highlighted the need for refined uses and criteria to protect aquatic life.

The UAA proposed for Straight Creek will be much less complex than the UAA conducted for the Chesapeake Bay. Some UAAs can be quite simple, as is the case in other states such as Kansas and Alaska. Our proposed UAA study does not and will not

presuppose the need for changes to the existing designated uses. However, it will help to identify and assess non-pollutant factors that may hinder attainment.

Many of the observed impacts to Straight Creek, both physical and chemical, may be irremediable based on the human caused conditions that exist. The stream channel morphology has been altered to compensate for flooding events, housing and roads. Additionally, both underground and surface mining prior to November 28, 1975 has likely altered Straight Creek's water chemistry. In heavily developed watersheds, natural or near-natural stream conditions may be unattainable due to pressures from human activity (USEPA 2005). The Group believes that the extensive physical and chemical alterations to Straight Creek provide reasonable grounds to justify further study.

1.4 The UAA and the Use-Change Process

A Use Attainability Analysis is only one step in the larger process that must be undertaken before a designated use can be changed or refined. The larger use-change process involves the following steps:

Step 1: Is the designated use an existing use?

YES The process ends and no change is made to the designated use.

NO Conduct a Use Attainability Analysis, then proceed to Step 2.

Step 2: Is the designated use attainable?

YES The process ends and no change is made to the designated use.

NO Proceed to Step 3.

Step 3: Is use attainment prevented due to any factor in 40 CFR 131.10(g)?

YES A new or refined use may be proposed. Proceed to Step 4.

NO The process ends and no change is made to the designated use.

Step 4: Initiate administrative process to promulgate amended water quality standards, and then submit amendments to EPA for review and approval.

Steps are reached only if criteria of each prior step are met.

The UAA process requires the identification of existing uses, assessment of factors preventing use attainment, and determination of the highest use attainable, which is the use attainable after all effluent limits and/or cost effective and reasonable best management practices are considered. If the designated use cannot be attained due to any factor in 40 CFR 131.10(g), then a use change may be justified.

1.5 The UAA and TMDL Implementation

The Straight Creek UAA is proposed for development during the same timeframe scheduled for Straight Creek TMDL Implementation. The Virginia Coalfields TMDL Group anticipates taking the lead role in TMDL Implementation Plan development. The UAA will be conducted independent of, yet parallel to TMDL Implementation. Neither effort will have to wait for completion of the other. Where aspects of one effort may complement the other, collaboration will be pursued. For example, the first phase of TMDL implementation will include the imposition of fecal bacteria and TSS controls, as well as source identification and monitoring of TDS. Monitoring data developed during TMDL implementation will be valuable to the UAA effort, and vice versa. Also, efficacy of TSS and fecal bacteria controls will be evaluated and incorporated into the UAA process. It should be noted, however, that the Straight Creek UAA process will in no way dilute or distract from TMDL Implementation.

2.0 Laws Governing Use Change (40 CFR 131.10)

2.1 General

Changing a designated use is a procedure bound by regulations set forth in 40 CFR 131.10. Those regulations identify the issues that must be addressed when creating or modifying designated uses. The following sections describe the issues most pertinent to our proposed UAA study.

2.2 Downstream Uses - 131.10(b)

A designated use must ensure that downstream water quality standards are maintained. The Straight Creek UAA will address those standards in Straight Creek's receiving water, the North Fork of the Powell River (NFP). The UAA will determine the relative impact of Straight Creek on NFP uses and ensure that those uses are protected.

2.3 Attainable Uses Defined – 131.10(d)

Before a designated use change is justified, it must be determined whether the designated use is realistically attainable with pollution controls. If a designated use is deemed attainable through pollutant control measures, then it cannot be removed.

EPA's regulations provide that "[a]t a minimum, uses are deemed attainable if they can be achieved through imposition of effluent limits required under sections 301(b) and 306 of the [Clean Water] Act and cost-effective and reasonable best management practices for nonpoint source control."

The Straight Creek UAA will evaluate pollutant control measures and the biological improvement expected from such measures. If those measures will allow for use attainment, then no use change will be appropriate.

2.4 Existing Uses – 131.10(g) & (h)

To be eligible for removal, a designated use must not be an existing use. A designated use is the use that is specified for the water body and the use that is protected by water quality criteria. An existing use is any use that has actually been attained in a water body on or after November 28, 1975. For example, a basic designated use for streams in Virginia is aquatic life propagation, meaning the stream must be of sufficient quality to support a balanced aquatic community. If, however, the stream is of high enough quality to support trout perennially and actually does so, that stream has attained a higher existing use, commonly called a "trout fishery". The trout fishery may be a higher use than what the original designated use intended, but as long as that use is attained, it is considered an existing use and cannot be removed.

The Straight Creek UAA, per USEPA guidance (USEPA 1983, 1994, 2005), will be designed to determine the existing uses, as well as the highest attainable uses. The UAA will also be designed to determine whether site-specific criteria may be necessary to protect the highest attainable uses.

3.0 Factors Justifying Use Change

3.1 General

EPA's regulations provide that changing a non-existing designated use is justified if attainment of the designated use is not feasible due to one or more of six factors described in 40 CFR 131.10(g). The following sections discuss these six factors and how our proposed UAA study will address each.

3.2 Naturally Occurring Pollutants

The geologic composition of a watershed significantly influences water quality. For example, waters in limestone valleys tend to have greater dissolved solids concentrations than streams in granites valleys. These geologic factors can often dictate the water quality of a stream. The water quality characteristics in such streams constitute the natural background water quality that cannot be altered. The Straight Creek UAA will investigate the natural background water quality to determine if it could be limiting use attainment.

3.3 Flow Conditions

Appropriate flow regimes are necessary to maintain healthy aquatic communities. In some streams, intermittent flow or extremely low flow may prevent attainment of a designated aquatic life use. In other streams, channel alterations have led to increased velocity and hydraulic energy which has a scouring affect on the substrate. Very low flow has been observed in Straight Creek during late summer as well as very high flows following rain events. Existing data suggest the extremes of flow may be having a negative impact on biological condition. The flow regime of Straight Creek will be investigated during the UAA process to determine whether flow conditions are limiting use attainment.

3.4 Human Caused Conditions

Straight Creek has a long history of human activity. Such activity has generated pollutants and non-pollutant pressures that ultimately influence the aquatic community. Some of those impacts may be remedied while some may not. In some cases, remediation may be technically possible, but only at significant and substantial environmental cost – that is, the cure is worse than the disease. The Straight Creek UAA will evaluate whether the impacts of human-caused conditions or sources of pollution can be remedied or are more damaging to remedy than leave in place. Non-pollutants are afforded thorough consideration in this step, as they can be influential factors dictating the health of the aquatic community.

Non-pollutants that impact aquatic communities include a wide range of ecological attributes, such as energy sources, biotic interactions, habitat quantity and quality, and hydrologic conditions. In the case of Straight Creek, many of these factors have been influenced by human activity for over 100 years. Some of these disturbances may be remedied, but many others may not. For example, much of the stream is bordered by private land with more than 1000 structures. It may not be realistic to relocate buildings from the stream banks to allow for riparian corridor restoration or to reconnect the creek to its natural floodplain. Changes such as relocation of the stream channel, channel straightening, concrete shoring of banks, house and road construction, and riparian habitat removal can all negatively influence the ecological factors that dictate biological condition.

In cases where a waterbody has significant human disturbance, a modification of the designated use may be justified under 40 CFR 131.10(g)(3), which allows a use change when human caused conditions prevent attainment of the default designated use and cannot be remedied or would cause more harm than if left alone. The following section presents examples of human alterations that have been observed in Straight Creek and the impacts each alteration could have on aquatic life. Given the presence of so many pressures in the watershed, the UAA will study these factors to determine which can be

remedied through effluent limits or application of cost effective and reasonable best management practices.

3.4.1 Riparian Corridor Disruption

Much of Straight Creek's riparian vegetative zone has been removed or disrupted. Houses have been constructed on landfill mine spoil. The Virginia Department of Transportation (VDOT) has removed floodplain vegetation to control flooding per Tennessee Valley Authority (TVA) recommendations. Riparian vegetation removal can increase transport of fine sediment to the stream (USEPA 1995). Sedimentation has been identified as a most probable stressor to the aquatic community. Restoration of riparian vegetation could help reduce sedimentation and improve aquatic life, but there are practical limits to what level of restoration is feasible. Most of Straight Creek is bordered by private land. Revegetation of the riparian corridor may be infeasible without relocation of hundreds of houses and other buildings, roads, bridges, and the railroad. The UAA will use EPA guidance to evaluate these factors and determine the level of remediation that is realistically achievable.

3.4.2 Canopy Removal

Nearly all of the mid-channel canopy and much of the bank canopy has been removed from Straight Creek. This was likely a VDOT-performed flood control measure, as described in 1965 flood relief plans by the TVA (TVA 1965). Loss of canopy could also be a result of other watershed urbanization and associated riparian disturbance. Reduced canopy can increase a stream's exposure to sunlight, which in turn can alter the stream's energy source, food web and aquatic community structure (Hawkins 1982). This may be occurring in Straight Creek, as evidenced by several biological surveys that indicate a high proportion of filter feeding macroinvertebrates. In addition, the general lack of trees also equates to a lack of large woody debris. In natural streams, large woody debris creates habitat and helps dissipate flood energy (Poff et al 1997). Straight Creek is absent this important feature that enhances habitat quality and quantity. Canopy restoration would require the planting of trees, an effort that will face the same impediments as

riparian revegetation discussed above. The UAA will use EPA guidance to evaluate these factors and determine the level of remediation that is realistically achievable.

3.4.3 Increased Impervious Surfaces

Pavement, roofs, and lawns are all considered impervious surfaces. Much of the land immediately adjacent to the banks of Straight Creek is comprised of impervious surfaces. High proportion of near-stream impervious surfaces can alter the hydrology of the stream which can lead to flooding, habitat loss (scouring), channel alteration, and sedimentation (Barnes et al 2001, USEPA 1997). The impervious nature of the watershed also increases the likelihood of flash flooding which can lead to scouring and habitat/organism loss. Such flooding was observed in Straight Creek in January 2006, when more than two inches of rain fell in 24 hours. The flashy nature of Straight Creek is unlikely to change, since it would require removal or relocation of many square miles of paved roads, rooftops, sidewalks, railroad, and lawns. The UAA will use EPA guidance to evaluate these factors and determine the level of remediation that is realistically achievable.

3.4.4 Sedimentation

Sedimentation has been identified as a most probable stressor to the aquatic community of Straight Creek. Excessive fine sediment impacts the benthic organisms that characterize a healthy stream. Sediment abrades aquatic organism gills during floods and smothers them upon deposition. The embedding nature of fine sediment also causes the loss of microhabitat in the spaces between larger substrate particles (Reylea 2000). While some BMPs may help reduce sedimentation somewhat, there are many aspects of the creek that may not be remedied. The extremely incised channel, bank shoring, and channel relocation have resulted in elevated hydraulic energy that will exacerbate scouring and instream sediment transport. The UAA will use EPA guidance to evaluate these factors and determine the level of remediation that is realistically achievable.

3.4.5 Total Dissolved Solids

Total Dissolved Solids (TDS) has been identified as a most probable stressor to the aquatic community of Straight Creek. In Straight Creek, recently collected data reveal that the highest observed TDS concentrations have coincided with very low flows during periods of little or no precipitation (Fall 2005). High flows following moderate rains have led to low observed TDS concentrations (Winter 2006). The nature of Straight Creek's TDS loading and concentration appears to fluctuate with precipitation. Further study is needed to better understand the nature of TDS in the Straight Creek watershed.

Best management practices are an option to remediate TDS, but effectiveness of TDS BMPs is not well understood. In fact, a federally funded study is underway to assess and quantify the effectiveness of different types of TDS BMPs. Additionally, BMPs of any kind may be of limited utility when overland flow is zero. The UAA will also examine these issues by identifying and quantifying the discrete sources and nature of TDS loadings in the Straight Creek watershed. These data will then be evaluated to determine the level of TDS reduction that is realistically achievable.

3.4.6 Watershed Urbanization Cumulative Effects

The individual pressures described above are all a result of over 100 years of urban development in the Straight Creek watershed. Taken cumulatively, such development can have persistent negative impacts on aquatic community diversity (Roy et al 2003). Development in the near-stream riparian corridor has been shown to strongly dictate local aquatic community structure (Sponseller et al 2001). It may be infeasible to remove businesses, homes, and abandoned buildings from the stream banks or remediate major riparian corridor alterations. The UAA will use EPA guidance to investigate these cumulative urbanization impacts and determine the level of remediation that is realistically achievable.

3.5 Hydrologic Modification

A significant non-pollutant that impacts aquatic life is stream flow regime. A natural flow regime allows a stream to dissipate its energy via meander, riffles and channel obstructions, and floodplain connectivity (Poff et al 1997). Hydraulic energy dissipation capacity is critical because it prevents excessive hydraulic forces from being transferred to important habitat and the biota itself. Human development in a watershed can significantly alter flow regime via hydrologic modification such as channel straightening, bank revetment, bridge construction, and dredging (Poff et al 1997, USEPA 1997). These activities have occurred in the Straight Creek watershed at some time in its history for various reasons.

In cases where the hydrologic character of a waterbody has been significantly altered and is incapable of being remedied, a modification of the designated use may be justified under 40 CFR 131.10(g)(4), which allows a use change when irreversible hydrologic modifications preclude attainment of the designated use. The following section presents examples of hydrologic modifications that have been made in the Straight Creek watershed and the impacts that each could have on aquatic life. Given the extent of such modifications, the UAA will use EPA guidance to study the modifications and determine which are remediable.

3.5.1 Channel Alteration

The Straight Creek watershed has a history of substantial hydrologic modification. Flood control measures date at least to 1965, when the TVA created flood relief plans (TVA 1965). Measures to speed the evacuation of flood waters and protect property are at odds with the natural channel structure that promotes a healthy aquatic community. Recent quantitative habitat surveys indicate that the stream channel is deeply incised with poor instream habitat diversity. The UAA will use EPA guidance to evaluate these factors and determine the level of remediation that is realistically achievable.

3.5.2 Channel Relocation

The stream channel has been relocated and straightened where needed to make space for buildings, roads, and other human development. In many places, the channel has been moved to the very edge of the valley floor, where bedrock is the (undesirable) primary substrate. The recent quantitative habitat surveys indicate that the stream, as its name implies, exhibits very little sinuosity. Natural streams rely on sinuosity to dissipate flood energy and increase habitat variety. As a result of the straight, relocated channel, habitat diversity is lower than is necessary for use attainment.

3.5.3 Bank Revetment

Straight Creek has been disconnected from its flood plain for most of its length due to bank revetment. The stream channel has evolved into an unnatural trapezoid after years of bank alteration. Such modifications were often conducted to allow for construction of public roads in the Straight Creek watershed. During high flow events the stream cannot dissipate hydraulic energy. Increased hydraulic energy can cause extreme scouring, including removal or organisms and attached algae food sources (Poff et al 1997).

3.5.4 Bank Stabilization/Shoring

Much of Straight Creek's banks are permanently shored with concrete or stone walls. This could make reestablishment of riparian zone vegetative protection difficult. Permanent shoring structures increase water velocity, which increases hydraulic energy.

3.6 Natural Physical Conditions

Health of the aquatic community is dictated by many physical factors such as habitat. In streams with suboptimal habitat quality and quantity, or other poor physical features, aquatic health can suffer. Straight Creek habitat surveys by VDEQ and others have revealed that poor habitat may be limiting aquatic life potential. Some of the poor habitat may be due to human activity, but some of it may be due to natural conditions of the

stream. The UAA will examine such natural physical conditions to determine if they could be limiting use attainment.

3.7 Widespread Economic and Social Burden

To be effective, water quality improvement measures must be realistically achievable. If such measures cannot be afforded by a municipality or local economy, then they are not realistically achievable. All options for watershed improvement will be considered in the UAA processes. Only those that are deemed realistically achievable will be considered for application. Additional measures could be necessary to attain the designated use, but may be socially and economically infeasible. In such a scenario, use attainment would be limited due to widespread social and economic impacts. The UAA will determine whether such situations exist for Straight Creek.

4.0 Next Steps

After a 30-day notice-and-comment period, comments received will be addressed and a final version of this document will be completed. Then, this reasonable grounds document to conduct a Use Attainability Analysis for Straight Creek will be presented in December 2006 to the Virginia State Water Control Board (Board) for approval to proceed. Following Board approval, the Virginia Coalfields TMDL Group will cooperate with Virginia DEQ to 1) develop a public participation plan, 2) develop the UAA technical study plan, and 3) create a schedule for all activities, with relevant milestones.

5.0 Literature Cited

Barnes, Kent B., John M. Morgan III, and Martin C. Roberge. 2001. Impervious Surfaces and the Quality of Natural and Built Environments. Department of Geography and Environmental Planning, Towson University. Baltimore, Maryland

Hawkins, C. P., M.L. Murphy, and N.H. Anderson. 1982. Effects of canopy, substrate composition, and gradient on the structure of macroinvertebrate communities in the Cascade Range streams of Oregon. Ecology 63(6): 1840-1856.

Poff, N. LeRoy, J. David Allan, Mark B. Bain, James R. Karr, Karen L. Prestegaard, Brian D. Richter, Richard E. Sparks and Julie C. Stromberg. 1997. The Natural Flow Regime. A paradigm for river conservation and restoration. BioScience 47(11): 769-784.

Reylea, C.D., G.W. Mincshall, R.J. Danehy. 2000. Stream Insects as Bioindicators of Fine Sediment. Watershed Management 2000 Conference. Boise, ID. Boise Cascade Corporation.

Roy, A. H., A. D. Rosemond, M. J. Paul, D. S. Leigh and J. B. Wallace. 2003. Stream macroinvertebrate response to catchment urbanisation (Georgia, U.S.A.). Freshwater Biology 48: 329–346.

Sponseller, R. A., E. F. Benfield and H. M. Valett. 2001. Relationships between land use, spatial scale and stream macroinvertebrate communities. Freshwater Biology 46: 1409-1424.

Tennessee Valley Authority. 1965. St. Charles, Virginia Flood Relief Plan, no. 0-6490. TVA Division of Water Control Planning, Flood Control Branch. Knoxville, Tennessee

United States Environmental Protection Agency. 1983. Technical Support Manual: Waterbody Surveys and Assessments for Conducting Use Attainability Analyses, Volume I. Office of Water. EPA 440-4-86-037. Washington, D.C. 20460

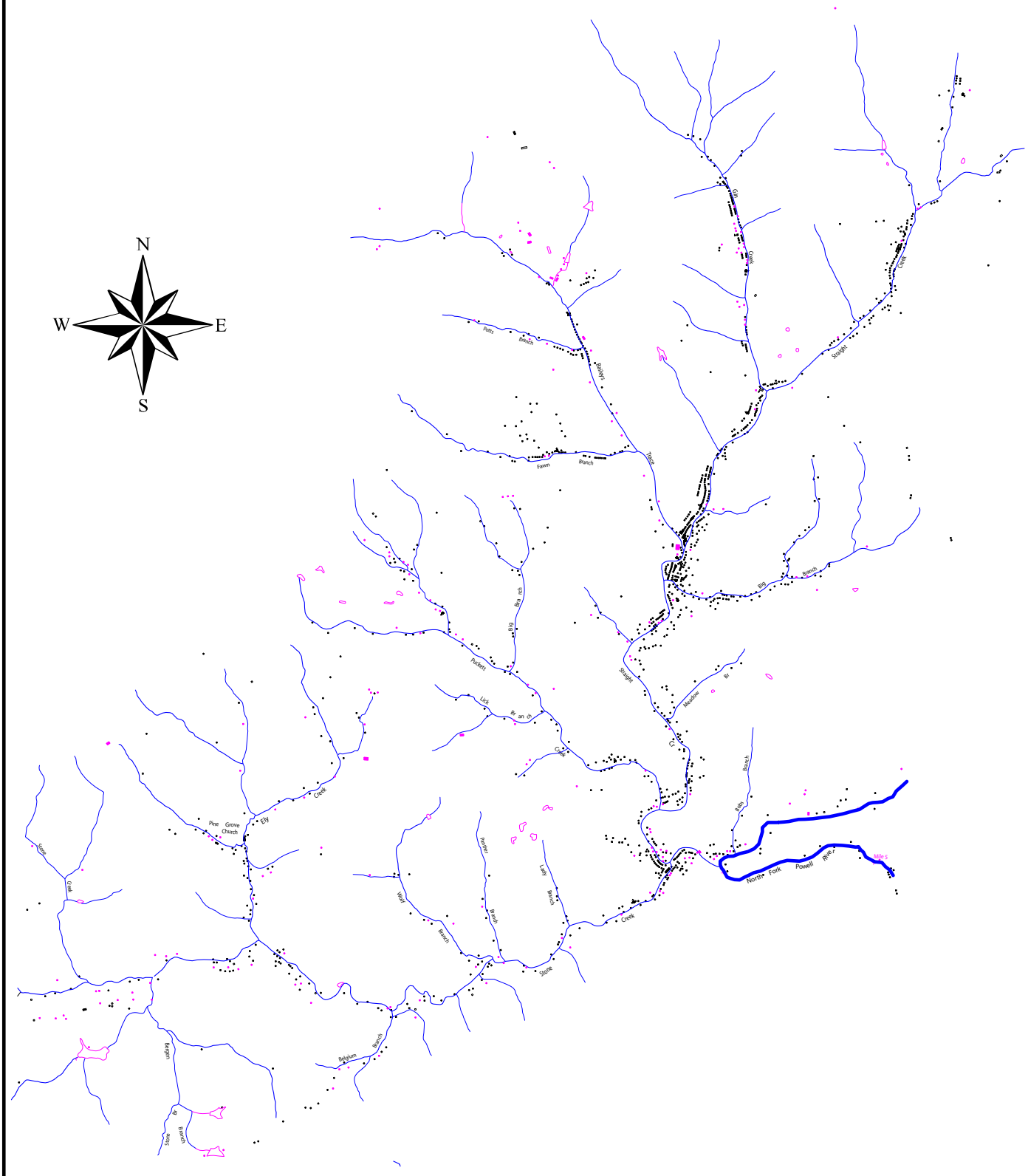
United States Environmental Protection Agency. 1994. Water Quality Standards Handbook: Second Edition. Office of Water. EPA 823-R-94-005. Washington, D.C. 20460

United States Environmental Protection Agency. 1995. Ecological Restoration: A Tool to Manage Stream Quality. Office of Water. EPA 841-F-95-007. Washington, D.C. 20460

United States Environmental Protection Agency. 1997. Urbanization and Streams: Studies of Hydrologic Impacts. Office of Water. EPA 841-R-97-009. Washington, D.C. 20460

United States Environmental Protection Agency. 2005. DRAFT: Use of Biological Information to Better Define Designated Aquatic Life Uses in State and Tribal Water Quality Standards: Tiered Aquatic Life Uses. Office of Science and Technology, Office of Water. Washington, DC 20460.

Straight Creek Watershed, Lee County Virginia
Watershed Detail Map



Biological Monitoring, Inc
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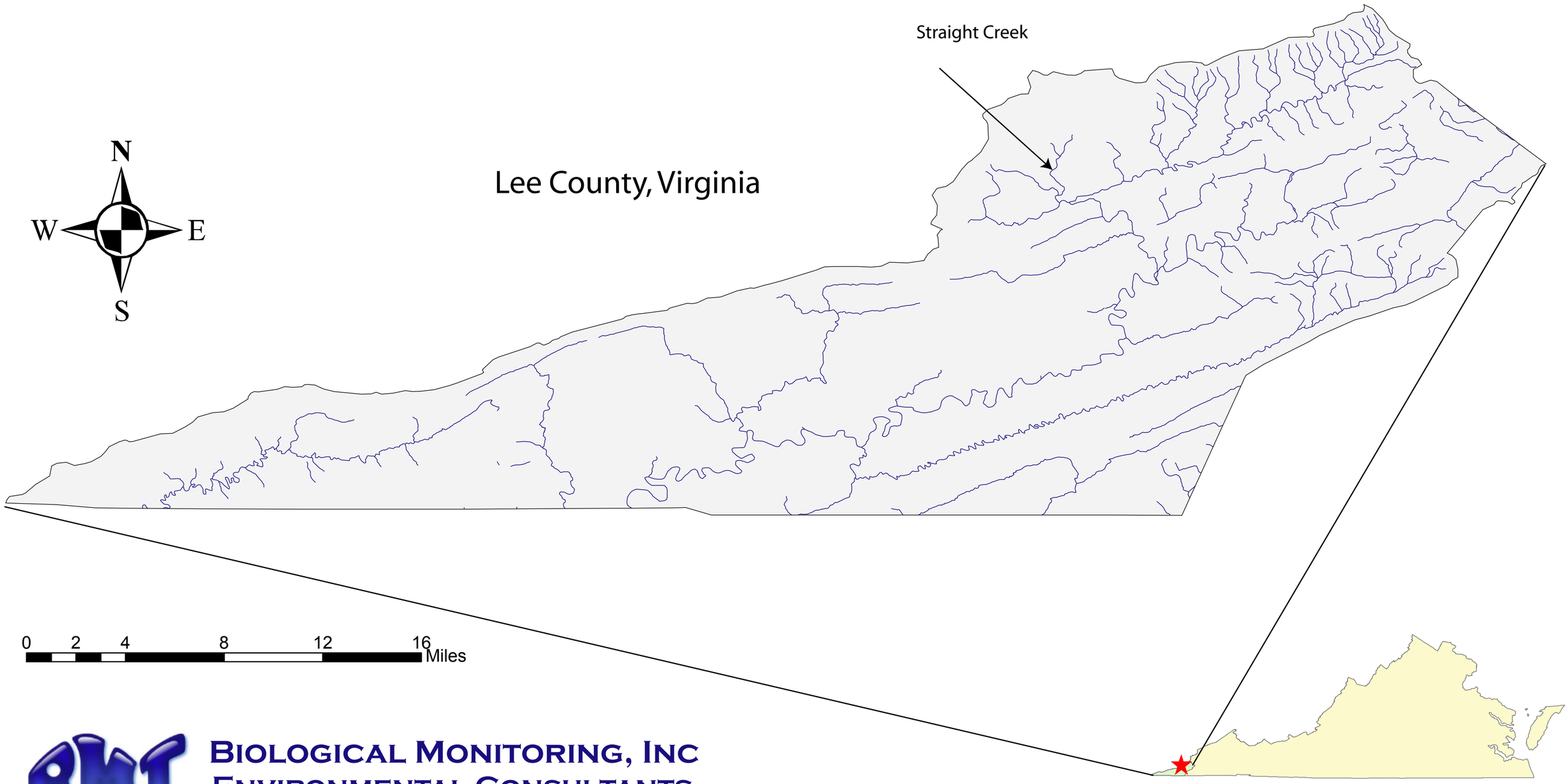
Straight Creek, Lee County Virginia

Study Area Map



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